APPARATUSES, SYSTEMS, AND METHODS FOR POSITIONING A POWERED TOOL

INVENTORS
Ian Chong
Jeff Johnson

PRIORITY CLAIM

This invention claims priority from United States Provisional Application No. 60/463,977, filed April 17, 2003.

FIELD OF THE INVENTION

This invention relates generally to tools and, more specifically, to support of a powered tool.

BACKGROUND OF THE INVENTION

Electrically, pneumatically, and hydraulically powered tools have greatly reduced labor demands and costs associated with construction, destruction, and renovation projects. To name one example, removal of concrete, masonry, stone, or other similar hard substances from a wall or another partially vertical surface once had to be performed by human laborers wielding hammers and/or chisels. The process was time consuming, demanded a great deal of energy and strength, and resulted in an appreciable cost chargeable to the project.

However, the advent of powered tools has simplified this process with the proliferation of devices such as chipping hammers. A chipping hammer, which is a small, generally handheld pneumatically-powered jackhammer, can be wielded by an individual to chisel away such substances in a fraction of the time.

As useful and beneficial as such as tool as a chipping hammer can be, however, the use of such a tool is not without its drawbacks. First, although a chipping hammer is light enough to be held by a human operator, a chipping hammer is still a relatively heavy appliance. In order to be able to provide useful impulse strength at the chisel tip, the chipping hammer desirably incorporates a reasonably sturdy – and therefore heavy – metal pneumatic cylinder. Similarly, the chisel installed in the chipping hammer must be hard, durable, and, once again, heavy. In addition, associated hardware, such as handles provided for gripping the device and fittings for receiving the pneumatic pressure from a compressor or similar device, also add weight to the device. Finally, because the chipping hammer is coupled through a hose sufficiently sturdy to provide pneumatic pressure, the drag weight of the pneumatic hose also contributes to the apparent, working weight of the chipping hammer when in use. All totaled, a typical chipping hammer weighs in the range of 15 to 25 pounds not even including the drag weight of the hose.

Although an object weighing 15 to 25 pounds does not present a troubling concern in terms of lifting or carrying the object, the task of holding a chipping hammer in one's hands supporting the chipping hammer at various angles presents a very significant physical challenge for the user. Unlike a jackhammer, which is used to remove hard materials from a floor or generally horizontal substance and is largely supported by a reaction force of a lower surface, an operator of a chipping hammer must provide continual support for the tool.

Second, positions in which an operator must wield a chipping hammer can be very strenuous and awkward. It is not unusual for an operator, standing on a ladder or scaffold to have to hold the chipping hammer away from his or her body, often having to reach upward or even support the tool over his or her head. Strain resulting from working above one's head is highly fatiguing and potentially injurious to the muscles, particularly those of the neck, shoulders, arms, and back, as well as throughout the body. Moreover, the strain

resulting from supporting a heavy implement above one's head, potentially for an entire work shift, day in and day out, is tremendously rigorous.

Last, but not least, not only is the chipping hammer a heavy tool, but by its very nature, operation of a chipping hammer results in relatively violent reciprocating movement and vibration. Unlike the jackhammer, whose recoil from the lower surface on which it is used is partially restrained by gravity, the chipping hammer must be restrained and controlled by the operator. Simply holding onto a tool moving with such force, to say nothing of the force of the tool continually recoiling from impact with the surface on which the operator operates the tool, is very strenuous. Such work strains both the larger muscles of the body, including the neck, shoulders, arms, and back, and also the smaller muscles of the body, including the wrists, hands, fingers, and knuckles. An instinctive reaction to tightly grip such a shaking, thrashing tool imparts further strain on the operator's body.

Operation of a chipping hammer presents a tremendous challenge for a strong, healthy operator. Accordingly, it will be appreciated what a challenge operating such a tool presents to an operator who is not as strong or healthy, including older operators or persons suffering from work-related or other physical limitations. Laws today are in place to ensure worker safety, and now also call for accommodations to challenged workers such that they, too, can perform their jobs.

Furthermore, relying on a human operator to both support and operate a vibrating, reciprocating tool presents a risk of harm. If the operator becomes fatigued or otherwise is not up to the challenge of supporting and controlling the tool, the tool could slip from his or her hands. The tool could fall or bounce away from the surface on which it is being used. An uncontrolled tool could cause damage to the surface on which the tool was being operated or the floor surface a falling tool could strike. Much worse, an out of control or falling tool could strike and injure the operator or others standing nearby.

It will be appreciated that a chipping hammer is not the only such device where such problems are manifest. Just to name one example, drills, particularly reciprocating concrete drills, also present a challenge to an operator in supporting, manipulating, and controlling such a device. In addition, grinders, sanders, buffers, polishers, pressure-washing nozzles,

sprayers, and many other tools present operational concerns when an operator must both operate a tool and support its weight.

Thus, there is an unmet in the art for an apparatus and a method to position and support a power tool. In particular, it is desired to be able to provide lightweight, portable support for a power tool to provide tool support in a wide range of situations.

SUMMARY OF THE INVENTION

The present invention provides an apparatus and method for positioning a powered tool for operation in a way that reduces physical demands on a human operator using the tool. Embodiments of the present invention include an extendable/retractable shaft and one or more swiveling joints at a base and/or a head of the shaft where the tool is mounted. Using embodiments of the present invention, the tool support can be swiveled at its base to position the tool in a desired range. The tool support can be extended or retracted in length through the use of one or more control pedals or other control devices to further position the tool. Also, being mounted to a swiveling head, the tool can also be tilted and otherwise adjusted to position the tool at a desired working positioning. It will be appreciated that these steps can be undertaken in any order or undertaken simultaneously or continuously to position the tool to a desired working position.

Embodiments of the present invention provide a number of benefits. Embodiments of the present invention help in supporting the weight of the tool and maintaining the tool in a desired operating position. As a result, physical demands of the operator are reduced. The tool can then be operated by a person not having the physical capacity ordinarily desired of an operator of the tool. A person with adequate strength and physical mobility to operate the tool without embodiments of the present invention will experience less strain and fatigue. By reducing physical demands, accidents may be avoided. Moreover, by supporting the tool, effectiveness of using the tool can be enhanced. Embodiments of the invention can be used with chipping hammers, drills, and other powered tools.

More particularly, apparatuses, systems, and methods for positioning a powered tool are provided. A support member has an adjustable length between a first end and a second end. A control device is operably coupled with the support member. The control device is

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

configured to receive a supply of a motivating force and to receive a user input. The control device is further configured to direct at least a portion of the motivating force to the support member to direct the support member to at least one of extend or contract as indicated by the user input received. A tool bracket configured for receiving a tool is disposed at the first end of the support member. A base end is disposed at the second end of the support member. The base end is configured to engage a supporting surface.

In accordance with further aspects of the invention, the support member includes an extensible cylinder. The extensible cylinder includes a shaft and a housing, with the shaft being slidable within an inner channel of the housing such that relative positioning of the shaft within the housing causes the support member to one of extend and contract. The support member may include a pressure cylinder and the motivating force may include a pressure source.

In accordance with other aspects of the invention, the control device may be configured to direct a pressure from the pressure source into the pressure cylinder, thereby causing the shaft to extend from the housing. Extension of the shaft from the housing causes the support member to extend when the user input indicates the support member is to be moved to an extend position. The control device also may be configured to direct a pressure from the pressure source into the pressure cylinder, thereby causing the shaft to retract into the housing. Retraction of the shaft into the housing causes the support member to contract when the user input indicates the support member is to be moved to a contract position. The control device also may be configured to release pressure from the pressure cylinder allowing the shaft to retract into the housing. Release of the pressure thereby allows the support member to contract when the user input device is motivated to a contract position.

Further in accordance with aspects of the present invention, the pressure cylinder includes a pneumatic cylinder and the pressure source includes a pressurized gas source. Alternatively, the pressure cylinder includes an hydraulic cylinder and the pressure source includes a pressurized liquid source. Further alternatively, the support member may include a plurality of slidable members coupled with at least one motorized coupling. The motorized coupling is configured to position the slidable members relative to each other such that a

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

relative positioning of the plurality of members causes the support member to one of extend and contract. The motorized coupling suitably includes at least one electric motor and the motivating force includes an electric power source.

In accordance with additional aspects of the present invention, the control device includes a multiple-position control including an extend position, a contract position, and a neutral position. The control device is configured such that when the multiple-position control is in the neutral position the control device neither directs the support member to extend nor to contract. Alternatively, the control device includes an extend control and a contract control, with the control device being configured so that when neither the extend control and the contract control is actuated, the control device neither directs the support member to extend nor to contract. The control device suitably includes at least one of a hand-operable device and a foot-operable device.

Also in accordance with aspects of the present invention, the tool bracket includes a tiltable coupling joining the tool bracket to the support member such that the tool bracket is tiltable relative to a position of the support member. The tiltable coupling includes at least one of rotatable joint and a swiveling joint. Also, the base end is configured to be tiltable relative to a surface engaging the base end. The base end suitably is joined with a base plate configured to tiltably receive the base end of the support member. The base plate may be joined with the base end of the support member with one of a hinged joint and a ball joint configured to tiltably couple the base end of the support member to the base plate.

BRIEF DESCRIPTION OF THE DRAWINGS

The preferred and alternative embodiments of the present invention are described in detail below with reference to the following drawings.

FIGURE 1 is a side view of a presently preferred embodiment of the present invention;

FIGURE 2A is a top view of one form of a control pedal for controlling extension and/or retraction of an embodiment of the present invention;

FIGURE 2B is a side view of the control pedal shown in FIGURE 2A;

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

FIGURE 2C is a top view of one form of a control pedal for controlling extension and/or retraction of an embodiment of the present invention;

FIGURE 2D is a side view of the control pedal shown in FIGURE 2C; and

FIGURE 3 is a flowchart of a routine for using a present invention.

DETAILED DESCRIPTION OF THE INVENTION

By way of overview, apparatuses, systems, and methods for positioning a powered tool are provided. A support member has an adjustable length between a first end and a second end. A control device is operably coupled with the support member. The control device is configured to receive a supply of a motivating force and to receive a user input. The control device is further configured to direct at least a portion of the motivating force to the support member to direct the support member to at least one of extend or contract as indicated by the user input received. A tool bracket configured for receiving a tool is disposed at the first end of the support member. A base end is disposed at the second end of the support member. The base end is configured to engage a supporting surface.

. FIGURE 1 is a side view of a presently preferred embodiment of a tool support 100 of the present invention. As shown in FIGURE 1, the tool support 100 supports a tool 102 such as a pneumatically-powered chipping hammer. The tool 102 has a body 104 which, in this example, consists primarily of a pneumatic cylinder housing which drives a tip 106 as is understood in the art. The tool 102 also features a handle 108 which, without the tool support 100, provides the principle means of support for the tool 102. The tool 102 also includes a power input 110 which, in this case, is a pneumatic pressure coupling for receiving a pneumatic hose 112 which drives the tool 102. The tool 102 also includes a mount 114 which allows the tool 102 to be secured to the tool support 100.

Although this description of the invention contemplates a tool 102 such as a chipping hammer being used with the tool support 100, it will be appreciated that the tool support 100 also could be used with other tools. Embodiments of the present invention can be used with any tools having any appreciable weight and/or generating reactive forces on the operator, such as grinders, sanders, buffers, polishers, pressure-washing nozzles, sprayers, drills,

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

reciprocating concrete drills, hole saws, and other tools. Benefits derived by an operator of a chipping hammer through the use of the tool support 100 similarly will be derived by operators of other tools.

The tool support 100 is coupled with the tool 102 at a swiveling or tiltable head 114. The tiltable head 114 allows for the tool 102 to be directed to operate at various angles. In one presently preferred embodiment, the tiltable head 114 suitably is a ball joint connector allowing for freedom of rotational movement in pitch, yaw, and to a lesser extent, roll. In other words, a ball joint allows for rotational, angular manipulation of the chipping hammer in all three planes in free-space. For another non-limiting example, the tiltable head 114 also suitably is a dual-hinged pivot, allowing the tool 102 to be rotationally turned in two directions determined by the positioning of the hinges. For another non-limiting example, the tiltable head 114 suitably is a single-hinged pivot having an axis disposed to allow the chipping hammer to be rotated about a single axis, with the single axis in this case extending perpendicularly from the page of FIGURE 1. As will be appreciated from the continued description below, additional freedom of movement of the tip 106 of the tool 102 can be gained by manipulating other controllable positioning aspects of the tool support 100.

The tiltable head 114 resides atop a support member 120. The support member 120 in the presently described embodiment includes an extensible/retractable shaft 124 extending from a housing 126. In one presently preferred embodiment, the housing supports a handle 128 which allows an operator to grip, turn, carry, and otherwise impart force to the housing 126 and, therefore, the tool support 120 as a whole. In addition, one presently preferred embodiment of the invention includes a support handle 129. The support handle 129 is coupled with the tiltable head 114 and extends from the tiltable head 114 perpendicularly both to an operational axis of the tool 102 and the support member 120. Thus, the support handle 129 advantageously provides a grip by which a user can control the position of the tool as well as to apply manual force as desired. If desired, an end of the support handle 129 can include a hand-operable control device for controlling extension and contraction of the support member in addition to the foot pedal 130, operation of which will be described further below..

BLACK LOWE & GRAHAM PLLC

701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

In one presently preferred embodiment of the tool support 100, the shaft 124 and the housing 126 are part of a pneumatically-powered cylinder assembly. In a pneumatically-powered embodiment, the shaft 124 is extended and retracted by selectively directing a motivating force in the form of compressed air from an externally supplied source into an end of the cylinder assembly. It will be appreciated by one of ordinary skill in the art that selective application of compressed air on one side of a piston driving the shaft 124 can be used to extend or retract the shaft 124 and thereby control deployment of the tool 102 mounted on the tool support. It will also be appreciated that application of compressed air on a side of the piston below the shaft 124 can be used to extend the shaft while, taking advantage of gravity, venting of pressure on the side of the piston below the shaft can be used to lower or retract the shaft in the exemplary embodiment shown. As also shown in FIGURE 1, the tool 102 receives its power input 110 from an auxiliary supply on a control pedal 130 for the sake of convenience in only running a single supply line (not shown) to the work environment. However, the tool 102 also can be operated from its own power input 110. Thus, the tool 102 may be powered using a different form of input power than the tool support 100.

Embodiments of the present invention are not limited to using a pneumatic cylinder assembly. It will be appreciated that a hydraulic cylinder assembly also could be used. Similarly, a motor-driven structure using electric or other motors could be used to extend or retract the shaft 124 from its housing 126. Other extending/retracting mechanisms also can be used to support a tool in accordance with embodiments of the present invention. For example, the extending/retracting mechanism could include a plurality of slidable members such as a rack and pinion system (not shown). In such an embodiment, extension and retraction of the extending/retracting mechanism could be facilitated by an electric motor driving the pinion to cause the relative displacement of the racks.

The support member 120 is extended or retracted in the exemplary embodiment shown by a pneumatic foot pedal 130. The foot pedal 130 receives a supply of compressed air (not shown) and selectively directs the flow of compressed air to one side of a piston to control the extension or contract of the support member 120. Depending on the actuation of

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

the foot pedal 130, compressed air will be directed to either an expanding pneumatic hose 132 or a retracting pneumatic hose 134 coupled with the housing 126 at respective input couplings (not shown). Alternatively, as previously described, actuation of the foot pedal 130 can be used to direct compressed air to extend the shaft 124 and to vent compressed air from the housing 126 to lower or retract the shaft. The hoses 132 and the operation of the foot pedal 130 will be further described in connection with FIGURES 2A-2D.

It will be appreciated that, in other embodiments of the invention, the foot pedal 130 could be hydraulic foot pedal for a hydraulic cylinder assembly, and electric switch for an electrical motor-driven assembly, or another control device appropriate to the construction of the cylinder. It will also be appreciated that the foot pedal 130 could be replaced or supplemented by hand-operable controls, finger-operable controls, or other controls mounted on the housing 126, on the support handle 129, or at another position to control extension of the shaft 124. In the exemplary embodiment shown, a foot pedal 130 is used to allow the operator to have both hands free to manipulate the tool 102.

Finally, the tool support 100 has a base 140. The base 140 supports the weight of the tool support 100 and the tool mounted thereon 102. The base 140 also suitably provides additional swivel mobility of the tool support 100 and, therefore, mobility of the tool 102 itself. In the exemplary embodiment shown, the base 140 is a shaft that allows the tool support to be rotated about a major axis of the support member 120 as well as pivoted in any direction relative to a surface on which the base 140 rests. It will be appreciated that the base 140 also could provide this degree of pivotal movement if the base 140 included a stand or base plate to be rested on the surface and a hinged joint, a swiveling ball and socket joint, or a similar joint were used to join the base plate and the housing 126. The described embodiment of the invention contemplates a base end 140 of the tool support 100 resting on a lower surface with the tool 102 coupled to an upper end of the tool support 100. However, it will be appreciated that the base end 140 of the tool support 100 could engage an upper surface or a side surface, with the tool 102 being coupled to a lower end or an opposite side end of the tool support.

BLACK LOWE & GRAHAM PLLC

701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

Considering FIGURE 1, it will be appreciated that the tool support 100 provides for a great deal of flexibility in positioning the tool 102 mounted thereon. The base 140 can be moved to reposition the entire apparatus. By applying force to the housing 126 relative to the base, the tool support 100 can be pivoted or tilted about the base 140, thereby allowing the tool support to be maneuvered in the plane above the surface on which the base 140 rests. The support member 120 can be extended or retracted to position the tiltable head 114 and, thus, the tool 102 at a range of distances relative to the base 140. The tool 102 can be swiveled about the tiltable head 114 to allow the tip 106 of the tool 102 to reach different locations or attack a surface at different angles. Such flexibility of linear and/or pivotal movement is highly useful when operating tools such as grinders, sanders, buffers, polishers, pressure-washing nozzles, sprayers, and other such tools which desirably are swept over a surface. Thus, the tool support 100 provides for a great deal of flexibility in positioning the tool 102 mounted on the tool support 100.

It will also be appreciated that the effectiveness of the tool 102 can be enhanced coupled with the tool support 100. For one non-limiting example, in many cases the operator of a chipping hammer must chip away material at a surface situated above his or her head. As a result, gravity works against the operator when the operator attempts to apply force to the chipping hammer to direct its impulse force against the desired part of the overhead surface. Using an embodiment of the present invention, however, the operator can use the tool support 100 to actually drive the tool 102 upwardly against the surface. The force applied to the tool 102 by the tool support 120 adds to the impulsive force generated by the tool itself. In sum, the force generated by the tool support 100 not only is useful for supporting and/or positioning the tool 102, but the force generated by the tool support also can be exploited to provide useful force to enhance in the operation of the tool 102 itself.

FIGURES 2A-2D show possible forms of control devices such as pedals 200 and 250 that can be used to control the extension and contraction of the tool support 120 (FIGURE 1). The control pedals 200 and 250 shown in FIGURES 1 and 2A-2D are foot pedals. However, as previously mentioned, embodiments of the present invention are not limited to using foot pedals. The controls shown in FIGURES 2A-2D could be adapted and positioned for hand,

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

finger, or other control of the device. As also was previously mention, exemplary embodiments of the invention described here use pneumatic pressure to operate the tool support 100 (FIGURE 1), although hydraulics, electronics, or other types of mechanisms could be used.

FIGURE 2A is a top view of one form of a control device in the nature of a control pedal 200 for controlling extension and retraction of the shaft 124 (FIGURE 1) according to an embodiment of the present invention. The control pedal 200 has a base 202 supporting the rest of the control pedal 200. In the exemplary embodiment shown in FIGURE 2A, the base 202 supports two foot pedals 204 and 206 for extending and retracting the shaft 124, respectively. An intake coupling 208 receives a supply of compressed air. In one embodiment of the present invention, depending on whether foot pedal 204 or 206 is depressed, the control pedal 200 will direct pneumatic pressure to an extension output coupling 210 or a retraction output coupling 211 to extend or contract the support member 120 (FIGURE 1), respectively. The couplings 210 and 211 are connected to appropriate extension and retraction input couplings (not shown) on the tool support 100 (FIGURE 1) to control deployment of the support member 120 (FIGURE 1). In another embodiment of the present invention, depending on whether foot pedal 204 or 206 is depressed, the control pedal 200 will direct pneumatic pressure to an extension output coupling 210 to extend the support member 120 (FIGURE 1). Alternatively, pressing pedal 206 suitably may release pneumatic pressure through the retraction output 211 to exploit gravity to lower or contract the support member 120 (FIGURE 1).

FIGURE 2B is a side view of the control pedal 200 shown in FIGURE 2A. As can be seen from FIGURE 2B, the foot pedals 204 and 206 are hingably mounted on a rotatable valve device 212. The valve device 212 both supports the foot pedals 204 and 206, but also directs the input pneumatic pressure to one of the output couplings 210 and 211 depending on which pedal 204 or 206 is depressed.

FIGURE 2C is a top view of another form of a control pedal 250 for controlling extension and contraction of the support member 120 (FIGURE 1) according to an embodiment of the present invention. The control pedal 250 has a base 252 supporting the

rest of the control pedal 250. Unlike the first form of the control pedal 200 (FIGURES 2A and 2B), in the exemplary embodiment shown in FIGURE 2C, the base 252 supports a single, dual action foot pedal 254 for extending and retracting the shaft 124, as will be further explained. An intake coupling 258 receives a supply of compressed air. In one embodiment of the present invention, depending on the direction in which the foot pedal 254 is depressed, the control pedal 250 will direct pneumatic pressure to an extension output coupling 260 or a retraction output coupling 261 to extend or contract the support member 120 (FIGURE 1), respectively.. The couplings 260 and 261 are connected to appropriate extension and retraction input couplings (not shown) on the tool support 100 (FIGURE 1) to control deployment of the shaft 124 (FIGURE 1). In another embodiment of the present invention, depending on the direction in which the foot pedal 254 is depressed, the control pedal 250 will direct pneumatic pressure to an extension output coupling 260 to extend the support member 120 (FIGURE 1) or vent pneumatic pressure through the retraction output 261 to exploit gravity to lower or contract the support member 120 (FIGURE 1).

FIGURE 2D is a side view of the control pedal 250 shown in FIGURE 2C. As can be seen from FIGURE 2D, the foot pedal 254 is hingably mounted on a bidirectional rotatable valve device 262. The valve device 262 supports the foot pedal 254 and directs the input pneumatic pressure to one of the output couplings 260 and 261. If a first end of the foot pedal 254 is depressed, pneumatic pressure is directed to the extension output coupling 260. Alternatively, if a second end 271 of the foot pedal 254 is depressed, pneumatic pressure is directed to the retraction output coupling 261.

FIGURE 3 shows a flowchart of a routine 300 for supporting a tool according to an embodiment of the present invention. The routine 300 begins at a block 302. At a block 304, it is determined if the tool support is aligned at its base so that the tool is positioned at a proper angle for the task relative to the base. If not, at a block 306 the tool support is swiveled at is base to position the tool at the proper angle relative to the base. If the tool is positioned at a proper angle or has been repositioned at a proper angle, at a block 310 it is determined if the tool support has been extended to an appropriate extension for the desired task. If not, at a block 312 it is determined if the tool support as deployed is not sufficiently

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

extended for the task. If not, at a block 314, the operator actuates a control pedal to extend the tool support. On the other hand, if the tool support is not too short for the task, at a block 316 it is determined if the tool support as deployed is overly extended for the task. If so, at a block 318, the operator actuates the control pedal to retract the tool support.

On the other hand, if at the block 310 the tool support length is determined to be appropriate, the tool support has been appropriately extended at the block 314, or the tool support has been appropriately retracted at the block 318, at a block 320 it is determined if the tool is deployed at a proper angle at the head of the tool support. If not, at a block 322 the tool is swiveled to position the tool for the desired angle of attack. If the tool is deployed at the proper angle at the head of the tool support has been swiveled to a proper angle, at a block 324 the tool is engaged.

As previously described, depending on the nature of the task for which the tool is being used, it might be of benefit to further extend the shaft to apply force to the tool, such as when driving a chipping hammer or drill into an overhead surface. Thus, at a block 326 it is determined if it is desirable to apply additional force to the tool. If so, at a block 328 the operator actuates a control pedal to extend (or, depending on the application, retract) the tool support. If it is determined at the block 326 that no additional force is desired, the routine continues at a block 330, and it is determined at a block 330 if the tool is needed at other positions or otherwise it is desired that the tool be repositioned. If so, the routine 300 loops to the block 304 and the routine 300 resumes. If not, at a block 332 the routine ends.

It will be appreciated that the steps of the routine outlined in FIGURE 3 are not rigid in their sequence. An operator of a tool and a tool support according to an embodiment of the present invention could undertake these steps in any order and/or execute the steps concurrently and/or continually to achieve desired position and operation of the tool. For one non-limiting example, if the tool support is used to support a sander or a grinder, the operator may desire to continually pivot and/or extend and retract the tool support to effect a sweeping motion over a surface of interest. It will be appreciated that embodiments of the invention suitably are used for such continual manipulation and repositioning.

BLACK LOWE & GRAHAM PLLC
701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301

While the preferred embodiment of the invention has been illustrated and described, as noted above, many changes can be made without departing from the spirit and scope of the invention. Accordingly, the scope of the invention is not limited by the disclosure of the preferred embodiment. Instead, the scope of the invention should be determined by reference to the claims that follow.

BLACK LOWE & GRAHAM PLLC

701 Fifth Avenue, Suite 4800
Seattle, Washington 98104
206.381.3300 • F: 206.381.3301